



SOCKEYE SALMON (Oncorhynchus nerka) STOCK ASSESSMENT AND
EVALUATION IN SOUTHEASTERN ALASKA, 1982-1983

By:
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IN SOUTHEASTERN ALASKA, 1982-1983¹

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ABSTRACT

Chilkoot and Chilkat Lakes received sockeye salmon (*Oncorhynchus nerka*) escapements of 101,973 and 78,986 fish, respectively, in 1982. The Lynn Canal drift gillnet fishery harvested 149,366 Chilkoot and 124,162 Chilkat sockeye salmon which comprised the highest catch for this district since statehood. In-season run strength analysis for the Chilkoot stock, using weekly catch and escapement figures, provided a data base which was used for in-season fishery management actions. Lag time between the fishery and arrival of fish at Chilkat weir excluded Chilkat escapement information from direct in-season management applications. In-season catch information for this stock provided a better indication of run strength than did the in-season escapement. Gear selectivity toward three-ocean fish appeared to have occurred during the 1982 season. Three-ocean fish occurred 11.5% and 27% more frequently in the catches of Chilkoot and Chilkat fish, respectively, than in their escapements. Conversely, two-ocean fish occurred more frequently in the escapement than in the catch. Returns of Chilkat sockeye salmon from known brood year escapements ranged from 2.2/spawner to 3.7/spawner. Returns from the 1976 and 1977 brood year escapements to Chilkoot Lake were 1.73 fish/spawner and 2.3/spawner, respectively. The 1982 Situk River and Tahltan Lake sockeye salmon escapements that were recorded at their respective weirs were 66% and 157% of the previous years' recorded averages.

KEY WORDS: Sockeye salmon, *Oncorhynchus nerka*, escapement, fishery, gear selectivity.

INTRODUCTION

Results of field activities and data collected by the Alaska Department of Fish and Game (ADF&G) during the 1 July 1982 through 30 June 1983 period was presented in this report. The area of primary concern reported herein was the Lynn Canal sockeye salmon (*Oncorhynchus nerka*) drift gillnet fishery and its associated spawning systems, Chilkoot and Chilkat Lakes. The first segment of this report covers stock contributions to the fishery, run strength analysis, evaluation of escapement goals, and evaluation of management techniques designed for this fishery.

Other facets addressed in this report are escapement data collected from other Southeastern Alaska sockeye salmon systems, most of which resulted from the U.S./Canada Salmon Stock Investigation Studies.

EVALUATION, REFINEMENT, AND IMPLEMENTATION OF STOCK IDENTIFICATION OF CHILKAT AND CHILKOOT LAKES SOCKEYE SALMON IN THE MANAGEMENT OF THE LYNN CANAL SOCKEYE FISHERY

Introduction

Maintenance of a proper balance between harvest and spawning escapement is the primary goal of the salmon fisheries manager. Escapements may be monitored as the fish enter their respective spawning systems. Although harvests are monitored, a means of allocating the catch of mixed stock fisheries to the respective stocks is necessary in order to identify the proportion of each stock entering the catch. Studies conducted on the Chilkoot and Chilkat Lakes sockeye salmon stocks (primary contributors to the Lynn Canal Inlet gillnet fishery) have revealed the existence of differential growth rates which occur between stocks rearing in these two lakes and which are subsequently recorded on the fish's scales (Bergander 1974). An in-season sampling program was initiated in 1981 (Marshall et al. 1982) and continued in 1982 which provided harvest stock composition information. Weekly management decisions were made after consideration of catch-per-unit-effort (CPUE), relative strength of escapements to the Chilkoot and Chilkat Rivers, appearance of the respective stocks in the harvest, the location within the area where these stocks occurred, and the timing of each stock. These data were evaluated weekly to determine where, and at what level, the respective stocks should be harvested.

The objectives were as follows:

- 1) Determine the strength of the respective runs.
- 2) Determine the contribution of Chilkoot and Chilkat Lake sockeye salmon stocks to the Lynn Canal gillnet fishery.
- 3) Evaluate and refine techniques designed to achieve desired escapement goals.
- 4) Evaluate existing escapement goals.

- 5) Explore methods of projecting escapements in-season prior to arrival of fish on the spawning grounds.

Escapement Enumeration

Escapement enumeration provided in-season and post-season information related to timing, relative magnitude, and age composition of the escapements to Chilkoot and Chilkat Lakes.

Methods:

Daily escapements of sockeye salmon were recorded at steel picket weirs located on the outlets of Chilkoot and Chilkat Lakes. Fish were netted as they passed through the weirs and used to provide scale samples for age analysis and scale characteristics for racial identification. Each fish sampled had its mid-eye-to-fork-of-tail length recorded and was released following the sampling procedure.

Results:

Chilkoot and Chilkat Lakes sockeye salmon escapements were 101,972 and 78,986 fish, respectively. The 1982 Chilkoot Lake escapement was the highest ever recorded, and the Chilkat escapement was the fifth highest since the weirs were first operated in 1976 and 1967, respectively (Table 1). Figures 1 and 2 present the daily escapements for Chilkoot and Chilkat weirs. Escapement at Chilkoot weir began to increase rapidly on 15 June, peaking at 5,256 fish on 18 June, and diminished to less than 1,000 fish per day by 27 June. A second surge in the daily rate of escapement began on 15 July and continued through 11 August, with the peak occurring between 23 and 29 July. Chilkat weir escapements began to increase gradually around 20 July with intermittent peaks occurring between 4 and 8 days apart; the peak daily escapement of approximately 12,000 fish occurred on 13 September.

Age analysis of the 1982 Chilkoot escapement is presented in Table 2. Age 1.3¹ fish comprised 78% of the escapement, followed in magnitude by age 1.2 fish, at approximately 19%. Other age classes were 0.3, 2.2, 1.4, and 2.3, none of which exceeded 1% of the total sample. Table 2 presents the Chilkoot age samples in three periods; 11 June through 18 July, 19 July through 30 July, and 31 July through 8 September. Age 1.3 fish were represented in the first sample period at 92%, decreasing through sample periods 2 and 3 to 68%; conversely, 1.2 age fish increased in percentage from 5.5% in the first sample period, to approximately 30% in the third sample period.

Table 3 presents the results of age analysis of the Chilkat Lake escapements. The age groups of the escapement in order of magnitude were; 2.2 at approximately 48%, age 2.3 at approximately 36%, and age 1.3 at 10%. The remaining 6% of the fish were comprised of age groups 1.1, 0.3, 1.2, 2.1, 3.2, and 3.3. Sample periods for the Chilkat escapement were broken down as follows: sample period 1, 27 June through 4 September; period 2, 8 September through 16 September; and period 3,

¹ European formula: Number of freshwater annuli - decimal - number of saltwater annuli. Total age is the sum of these two plus one.

Table 1. Annual sockeye salmon escapements through Chilkat and Chilkoot weirs, 1967-1982.

Year	Sockeye	Coho	Pink	Chum	Total	Period Operated
Chilkat						
1967	22,343				22,343	6/13 - 9/15
1968	41,256	168	4		41,428	6/07 - 9/13
1969	44,555				44,555	5/27 - 9/16
1970	41,085				41,085	5/29 - 9/17
1971	49,342	1,063			50,405	5/25 - 10/20
1972	51,860	518			52,278	6/03 - 10/12
1973	50,554	167			50,721	6/07 - 10/15
1974	84,237	161			84,448	5/30 - 10/12
1975	41,508	644			42,152	6/04 - 11/06
1976	69,984	204			70,188	6/03 - 9/27
1977	40,334				40,334	6/03 - 9/27
1978	69,498	390			69,888	6/05 - 11/05
1979	80,588	965			81,553	6/09 - 11/11
1980	85,066	N/A			85,066	6/05 - 10/08
1981	84,125	1,150			85,275	6/08 - 10/23
1982	78,986	157			79,143	6/24 - 10/06
Chilkoot						
1976	71,294	942	¹	242	72,478	5/23 - 10/31
1977	97,212	1	5,368 ¹	165	102,746	5/28 - 9/12
1978	35,452	1,179		227	36,858	6/06 - 11/07
1979	95,948	899		253	97,100	6/05 - 11/06
1980	96,217	628		720	97,565	6/02 - 10/05
1981	81,890	1,479	¹	269	83,639	6/04 - 10/12
1982	101,973	5		507	102,485	6/03 - 9/14

¹ Pink salmon were able to pass through the weir uncounted due to the width of the spacing between pickets. Even if pink salmon passing through the weir could have been counted, the count would not have reflected the systems escapement due to undetermined downstream estuarine spawning.

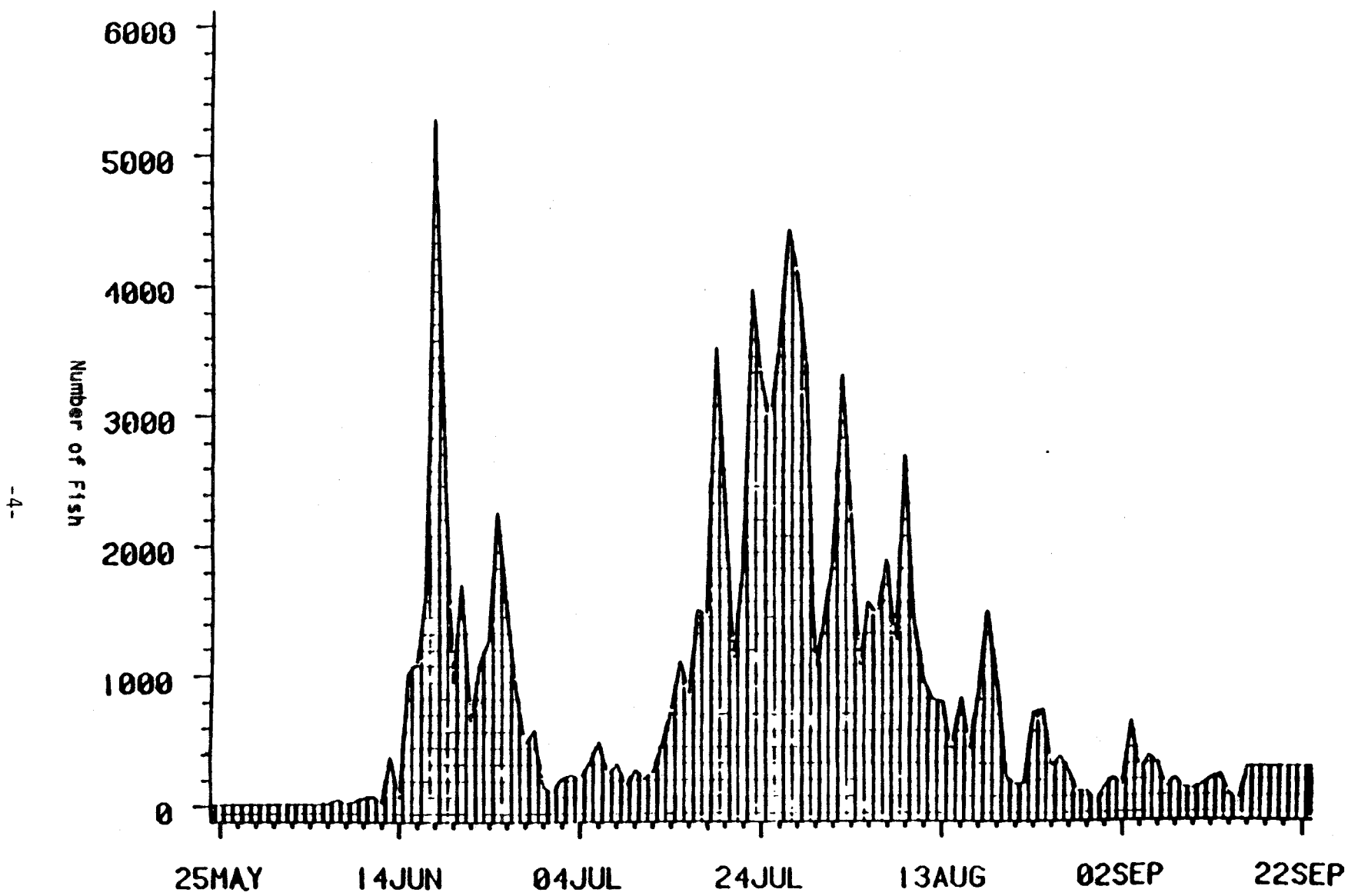


Figure 1. Chilkoot Lake weir daily sockeye salmon escapement, 1982.

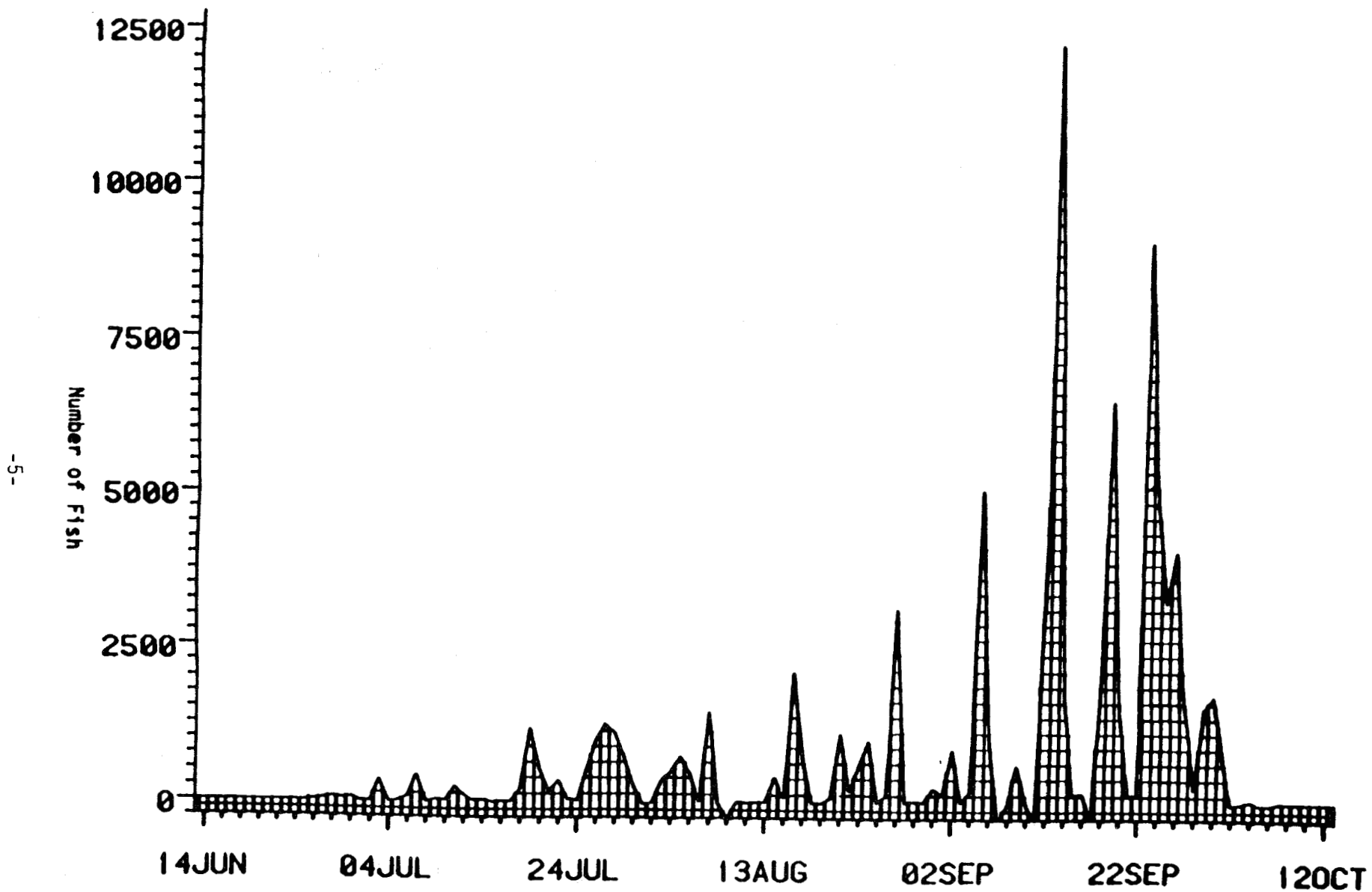


Figure 2. Chilkat Lake weir daily sockeye salmon escapement, 1982.

Table 2. Age composition of the Chilkoot Lake escapement by period and sex, Southeastern Alaska, 1982.

PERIOD	SEX		BROOD YEAR AND AGE CLASS ¹						Total
			1978		1977		1976		
			0.3	1.2	1.3	2.2	1.4	2.3	
JUNE 11-JULY 18 (N=563)	MALE	COUNT	235	998	16,327	0	176	352	18,080
		PERCENT	.71	3.02	49.30	0.00	.53	1.06	54.71
	FEMALE	COUNT	0	822	14,094	59	0	0	14,975
		PERCENT	0.00	2.49	42.63	.10	0.00	0.00	45.29
	SEXES COMBINED	COUNT	235	1,820	30,421	59	176	352	33,063
		PERCENT	.71	5.50	92.01	.10	.53	1.06	100.00
JULY 19-JULY 30 (N=566)	MALE	COUNT	0	2,948	12,359	125	376	314	16,122
		PERCENT	0.00	8.30	34.81	.35	1.06	.88	45.41
	FEMALE	COUNT	0	4,767	14,115	251	125	125	19,383
		PERCENT	0.00	13.43	39.75	.71	.35	.35	54.59
	SEXES COMBINED	COUNT	0	7,715	26,474	376	501	439	35,505
		PERCENT	0.00	21.73	74.56	1.06	1.41	1.24	100.00
JULY 31-SEPT. 8 (N=562)	MALE	COUNT	0	4,836	12,305	0	306	0	17,447
		PERCENT	0.00	14.06	35.77	0.00	.89	0.00	50.71
	FEMALE	COUNT	0	5,387	11,265	122	0	184	16,958
		PERCENT	0.00	15.66	32.74	.35	0.00	.53	49.29
	SEXES COMBINED	COUNT	0	10,223	23,570	122	306	184	34,405
		PERCENT	0.00	29.71	68.51	.35	.89	.53	100.00
TOTAL (N=1,691)	MALE	COUNT	235	8,782	40,991	125	858	666	51,657
		PERCENT	.23	8.53	39.81	.12	.83	.65	50.17
	FEMALE	COUNT	0	10,976	39,474	432	125	309	51,316
		PERCENT	0.00	10.66	38.33	.42	.12	.30	49.83
	SEXES COMBINED	COUNT	235	19,758	80,465	557	983	975	102,973
		PERCENT	.23	19.19	78.14	.54	.95	.95	100.00

¹ European formula: Number of freshwater annuli - decimal - number of saltwater annuli. Total age is the sum of these two plus one.

Table 3. Age composition of the Chilkat Lake escapement by period and sex, Southeastern Alaska, 1982.

			BROOD YEAR AND AGE CLASS ¹									
			1979	1978		1977		1976		1975		
PERIOD	SEX		1.1	0.3	1.2	2.1	1.3	2.2	2.3	3.2	3.3	TOTAL
JUNE 27-SEPT. 4 (N=586)	MALE	COUNT	71	0	459	212	3,919	2,683	3,496	35	35	10,910
		PERCENT	.34	0.00	2.22	1.02	18.94	12.97	16.90	.17	.17	52.7
	FEMALE	COUNT	0	35	530	0	2,895	4,026	2,295	0	0	9,781
		PERCENT	0.00	.17	2.56	0.00	13.99	19.46	11.09	0.00	0.00	47.2
	SEXES COMBINED	COUNT	71	35	989	212	6,814	6,709	5,791	35	35	20,691
		PERCENT	.34	.17	4.78	1.02	32.93	32.42	27.99	.17	.17	100.0
SEPT. 8-SEPT. 16 (N=529)	MALE	COUNT	46	0	92	1,061	231	4,890	5,951	231	46	12,540
		PERCENT	.19	0.00	.38	4.35	.95	20.04	24.39	.95	.19	51.4
	FEMALE	COUNT	0	0	92	0	185	7,611	3,783	185	0	11,856
		PERCENT	0.00	0.00	.38	0.00	.76	31.19	15.50	.76	0.00	48.5
	SEXES COMBINED	COUNT	46	0	184	1,061	416	12,501	9,734	416	46	24,404
		PERCENT	.19	0.00	.75	4.35	1.701	51.23	39.89	1.70	.19	100.0
SEPT. 17-OCT. 3 (N=517)	MALE	COUNT	204	0	204	951	340	7,608	7,270	408	0	16,985
		PERCENT	.58	0.00	.58	2.71	.97	21.66	20.70	1.16	0.00	48.3
	FEMALE	COUNT	0	0	204	0	272	11,414	5,911	340	0	18,141
		PERCENT	0.00	0.00	.58	0.00	.77	32.49	16.83	.97	0.00	51.6
	SEXES COMBINED	COUNT	204	0	408	951	612	19,022	13,181	748	0	35,126
		PERCENT	.58	0.00	1.16	2.71	1.74	54.15	37.52	2.13	0.00	100.0
TOTAL (N=1,632)	MALE	COUNT	321	0	755	2,224	4,490	15,181	16,717	674	81	40,443
		PERCENT	.40	0.00	0.94	2.77	5.60	18.92	20.84	0.84	0.10	50.41
	FEMALE	COUNT	0	35	826	0	3,352	23,051	11,989	525	0	38,778
		PERCENT	0.00	.04	1.03	0.00	4.18	28.75	14.94	0.65	0.00	49.59
	SEXES COMBINED	COUNT	321	35	1,581	2,224	7,842	38,232	28,706	1,199	81	89,221
		PERCENT	.40	.04	1.97	2.77	9.78	47.67	35.78	1.49	0.10	100.00

¹ European formula: Number of freshwater annuli - decimal - number of saltwater annuli. Total age is the sum of these two plus one.

17 September through 3 October. Age 2.3 fish appeared at approximately 28% in the first period, 40% in the second, and approximately 38% in the third period. Age 2.2 fish appeared in periods 1 through 3 at 32.4%, 51.2%, and 54.2%, respectively.

Discussion:

The dominant parent year for returning 5-year Chilkoot fish was 1977. The timing of the 1977 brood year was such that by 21 June 54,519 sockeye salmon had passed through Chilkoot weir. Considerable attention was given to the 1982 Chilkoot escapement in anticipation of a possible repetition of the 1977 escapement pattern (Bergander 1979). Although the early season peak in escapement first observed in 1977 failed to appear in 1982, a minor surge was observed which peaked on 18 June. The timing of the main July peak was similar to that observed in previous years, excluding 1977.

The timing of the Chilkat escapement demonstrated the same general pattern as other years of record, beginning slowly with a few minor peaks, followed by a major peak in September. The September surge in escapement has been observed to range from 17% to 85% of the seasons total; the 1982 September segment represented 75% of the seasons escapement. These late arrivals of Chilkat fish at the weir prevent management from using the escapement for in-season fisheries regulatory application.

The age structure of the Chilkoot escapement consisted of predominantly 1.3 age fish. The decline in percent composition of the older 1.3 age fish and the increase in 1.2 age fish as the season progressed followed the classic pattern of older fish returning first and younger fish returning at a later date.

There was no distinct difference in timing within the Chilkat stock as demonstrated by the Chilkoot stock.

Stock Contribution

Identification of stocks contributing to mixed stock fisheries produces information related to production from various levels of brood year escapements, harvest rates, timing of different stocks as they appear in the fishery, and in-season run strength evaluation.

Methods:

Scale samples were collected from the catch at Excursion Inlet cannery as the tenders unloaded the weekly catches taken in Lynn Canal. The sample size was 400 scales per week. These scales were analyzed by ADF&G personnel to determine the age and stock composition of the catch. The percent composition of each stock and age group within stocks was expanded to present these data as numbers of fish in the catch.

Results:

The combined results of the analysis for the catch and escapement is presented in Table 4. During the 1982 season Chilkoot Lake contributed 149,366 sockeye salmon to the catch and 102,973 to the escapement, yielding a total Chilkoot run of to

Table 4. Expanded catch, escapement, and total return of sockeye salmon to Lynn Canal (District 115) by age class and system based on scale analysis, 1982¹.

System			-----Age Class-----				Other	Total
			1.2	2.2	1.3	2.3		
Chilkoot	Catch	Numbers	11,855	893	131,861	4,211	546	149,366
		Percent	7.9	0.6	88.3	2.8	0.4	100.0
	Escapement	Numbers	19,525	506	81,037	921	984	102,973
		Percent	19.0	0.5	78.7	0.9	1.0	100.0
	Total Run	Numbers	31,380	1,399	212,898	5,132	1,530	252,339
		Percent	12.4	0.6	84.4	2.0	0.6 ²	100.0
Chilkat	Catch	Numbers	1,632	30,280	23,092	66,547	2,611	124,162
		Percent	1.3	24.4	18.6	53.6	2.1	100.0
	Escapement	Numbers	1,628	38,453	7,792	28,494	3,854	80,221
		Percent	2.0	47.9	9.7	35.5	4.8	100.0
	Total Run	Numbers	3,260	68,733	30,884	95,041	6,465	204,383
		Percent	1.6	33.6	15.1	46.5	3.2 ³	100.0

¹ McPherson, McGregor, and Marshall, 1983.

² The estimated abundance by age class in the "other" category for the Chilkat Lake run was: age 1.1, 5.0%; age 2.1, 35.1%; age 3.2, 32.8%; age 0.3, 11.9%; age 3.3, 14.5%; age 0.4, 0.7%.

³ The estimated abundance by age class in the "other" category for the Chilkoot Lake run was: age 0.3, 17.3%; age 0.4, 0.1%; age 1.4, 82.6%.

252,339 fish. The dominant age class in the Chilkoot catch and escapement was the 1.3 group, represented at 88.3% and 78.7% in the catch and escapement, respectively. The second largest age group was 1.2 represented at 7.9% and 19.0% in the catch and escapement, respectively.

The Chilkat Lake stock contributed 124,162 sockeye salmon to the fishery, and 80,221 to the escapement, bringing the total run to 204,383 fish. The major Chilkat age class was 2.3, comprising 53.6% of the catch and 35.5% of the escapement. The 2.2 year fish comprised the second major age group.

Discussion:

The 1982 Lynn Canal catch of 273,528 sockeye salmon represented the highest catch since statehood. Prior to statehood, catch records show a high catch of 166,985 in 1954 (Alaska commercial salmon catch statistics). Earlier records included fish taken in other areas and brought into the Lynn Canal area for processing, however, making these records unsuitable for comparative purposes. Until recently the numbers of fish harvested from each stock was undetermined.

Gear selectivity may have been a factor contributing to the difference in percentage of occurrence between catch and escapement of Chilkat fish in the 2.2 and the 1.3 age groups. The 2.2 fish appeared in the escapement at a higher percentage than they did in the catch; conversely the 1.3 and 2.3 age groups represented a higher percentage of the catch than they did of the escapement. This apparent selectivity appeared to have been related to ocean age wherein the large 3-ocean fish may have been more prone to capture than the 2-ocean fish.

Gear selectivity appeared, also, with the Chilkoot stock; however, due to the relatively low incidence of 2-ocean fish found in this stock during the 1982 season, selectivity was less obvious than for the Chilkat fish. If large returns of 2-ocean Chilkoot fish should occur, however, management's ability to intercept these fish may be reduced because of the tendency of the smaller 2-ocean fish to pass through the gear. This situation may already exist in the fishery on the Chilkat sockeye. The management implications are: (1) run strength may be underestimated and, (2) escapement goals may be exceeded.

Run Strength of Chilkoot and Chilkat Stocks

Determination of run strengths of the respective stocks being harvested in a fishery is an essential facet of fisheries management. The development of a data base that might be used for an in-season reference is presented in this study segment.

Methods:

Run strength was determined for each stock as the total of its escapement and contribution to the harvest. Weekly cumulative escapements were determined from daily escapement data collected at Chilkoot and Chilkat weirs. Weekly stock composition of the catch was determined from data produced from the analysis of scale samples collected from each fishing period's Lynn Canal gillnet catch (McPherson 1983).

Results:

Cumulative escapements to Chilkoot and Chilkat Lakes for 1982 were compared with average escapements (1976-82) to these systems in Figures 3 and 4, respectively, and Table 5 presents a comparison of the 1982 catch of Chilkoot and Chilkat stocks with the previous 6-year average. The 1982 weekly catch for both stocks was average through the week of 11-17 July. Beginning with 18 July, however, the catch of Chilkoot fish was approximately double that of the previous 6-year average for that week. The peak catch of 35,000 Chilkoot fish occurred between 25-31 July. The cumulative escapement to Chilkoot by 18 July had reached approximately 42,000 fish (Figure 3).

Between 25 and 31 July the catch of Chilkat fish exceeded the previous 6-year average catch by approximately 100%; however, the cumulative escapement to Chilkat Lake by 31 July was 4,894 fish, or approximately 50% of the previous 6-year average escapement for that date (Figure 4).

The end-of-season total catches of Chilkoot and Chilkat fish were 275% and 182% of their respective 6-year averages.

Discussion:

The in-season evaluation of run strength to Chilkoot Lake, using weekly catch and escapement, provided a timely and accurate assessment of the strength of this stock during the 1982 sockeye salmon season. The timeliness of the information provided a base which could be used reliably for the formulation of in-season regulatory actions.

The in-season catch information for the 1982 Chilkat run indicated good strength in the return of this stock. However, the in-season escapement data for Chilkat Lake contradicted the catch data, indicating the possibility of a weak return. Post-season escapement data for Chilkat showed that the escapement goals for the season had actually been exceeded by approximately 12%. It appears from the data that, during the 1982 season, the in-season catch information was a better indicator of the run strength than the escapement. However, in the interest of achieving an adequate escapement the management of the Chilkat stock was somewhat conservative, resulting in the escapement of approximately 9,000 fish more than was considered necessary.

Evaluate and Refine Techniques Designed to Achieve Desired Escapement Goals

In-season regulatory orders were implemented which encompassed time allowed for fishing and area to be fished. These decisions were made after considering escapements to date, catch-per-unit-effort, and gear density. The final evaluation of the effectiveness of the management techniques centered on the escapements through Chilkoot and Chilkat weirs.

Methods:

Escapement information was collected at Chilkoot and Chilkat weirs. Preliminary catch information was collected on the grounds by area management biologists. To determine the magnitude of the weekly catch, by stock, it was necessary to determine the stock composition so the catch could be allocated to the respective

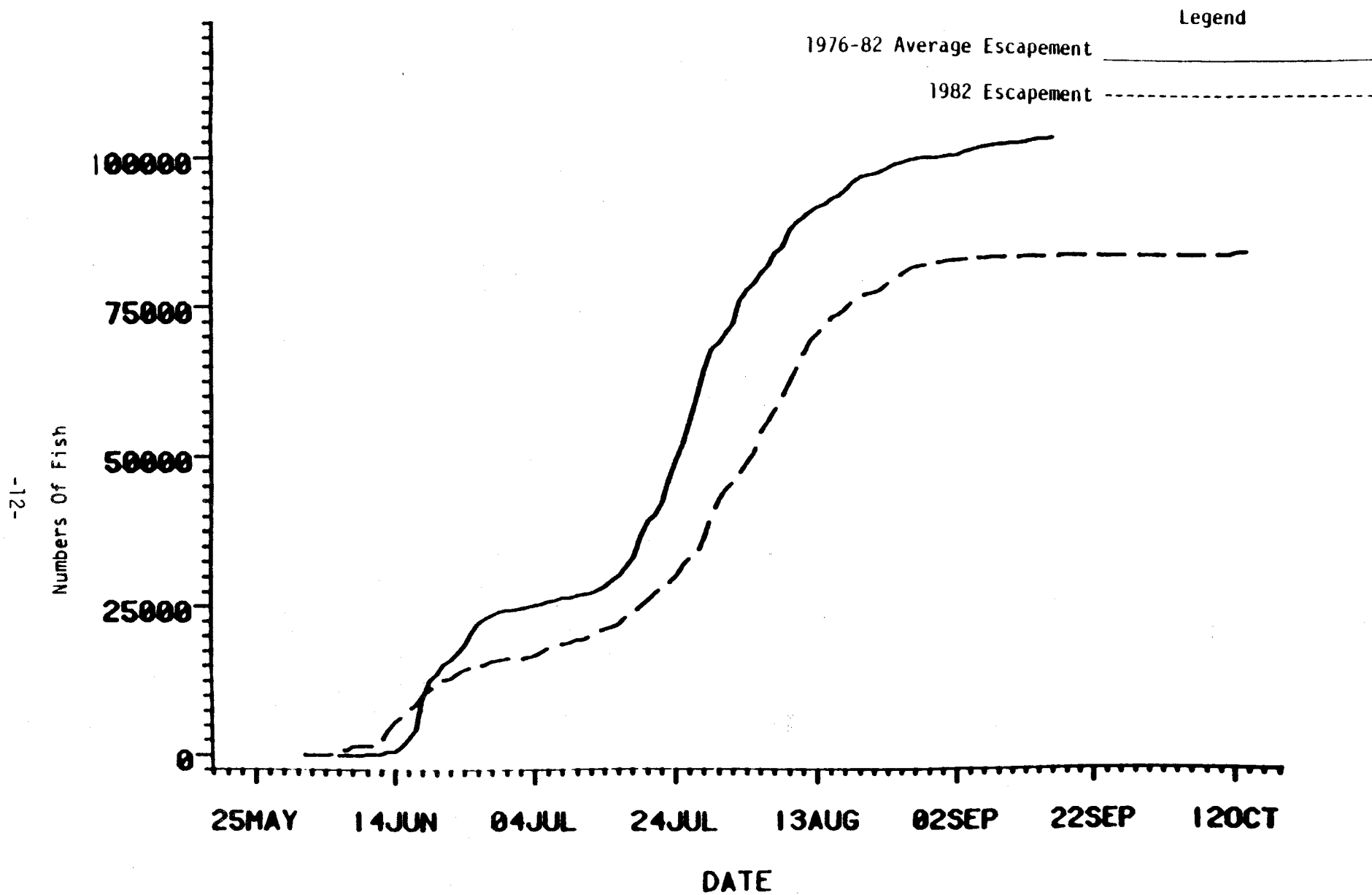


Figure 3. Chilkoot weir 1982 and 1976-1982 average cumulative daily sockeye salmon escapements.

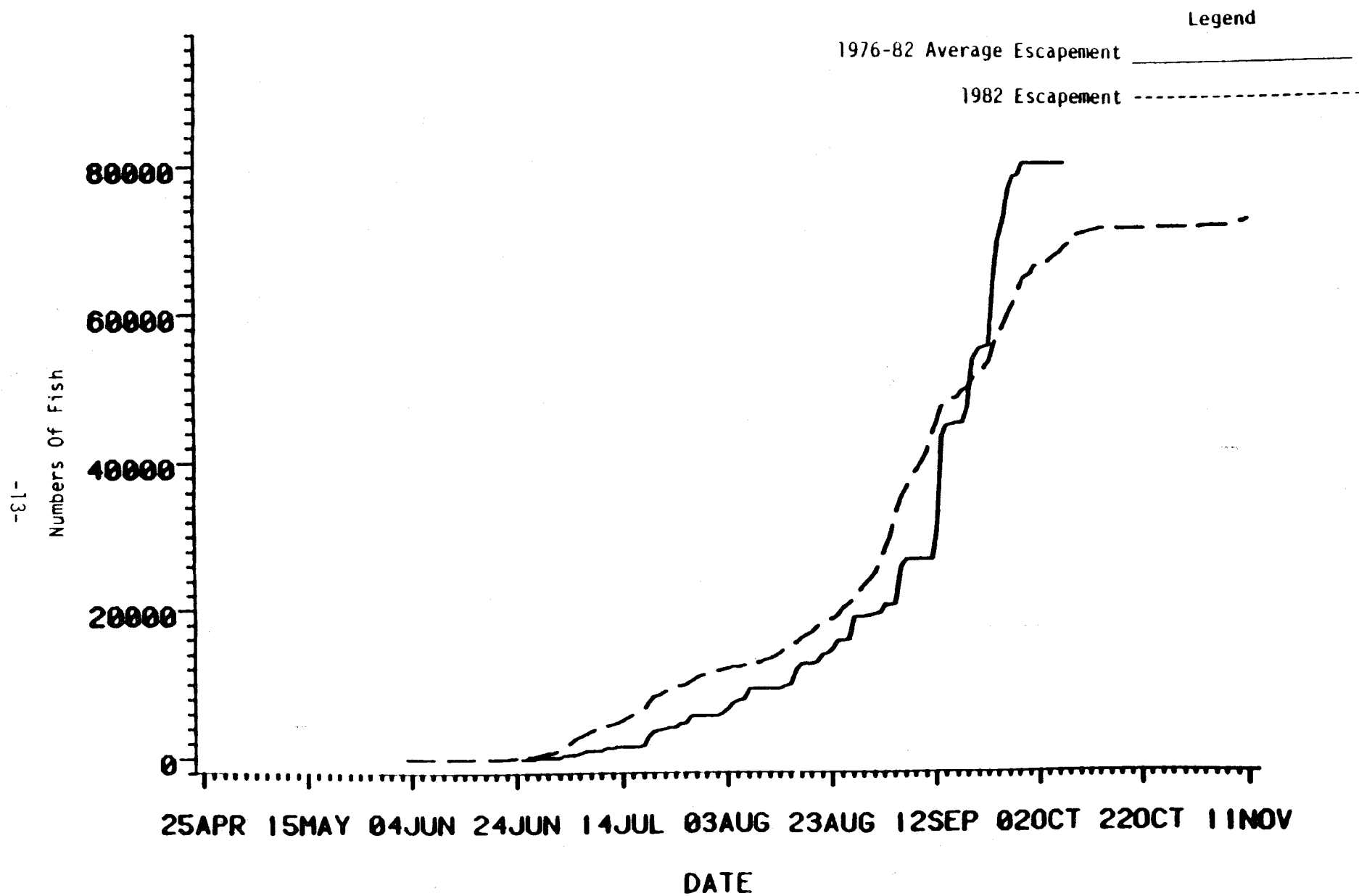


Figure 4. Chilkat weir 1982 and 1976-1982 average cumulative daily sockeye salmon escapements.

Table 5. Average Lynn Canal sockeye salmon catch by stock by statistical week, 1976-1981 vs 1982 Lynn Canal catch by stock.

Stat Week	Period ¹	-----Stock-----			
		----6 yr. Average----		-----1982-----	
		Chilkat	Chilkoot	Chilkat	Chilkoot
24		0	78	0	0
25	6/13-14	1,213	1,805	722	2,008
26	6/20-23	3,509	5,278	2,379	3,802
27	6/27-30	2,660	4,382	3,821	4,202
28	7/4-7	2,301	5,689	3,186	5,213
29	7/11-13	2,830	5,127	2,817	5,569
30	7/18-20	5,126	4,949	1,805	10,817
31	7/25-28	8,419	5,758	12,454	35,500
32	8/1-3	12,934	10,404	26,268	29,467
33	8/8-13	9,143	5,677	29,914	22,270
34	8/16-20	8,067	3,291	11,361	19,306
35	8/22-27	9,837	1,347	14,795	9,717
36	8/29-31	1,318	402	10,540	889
37	9/5-7	544	52	1,856	518
38	9/12-14	277	14	1,388	55
39	9/19-21	68	15	663	26
40	9/26-28	13	0	193	7
Total		68,259	54,268	124,112	149,359

¹ 1982 statistical week dates.

stocks, thereby providing an estimate of the total run of each stock passing through the area by week.

The actual evaluation was based on the following considerations: (1) whether the escapement goals were met and, (2) if not, how close the escapements were to the desired goals.

Results:

Escapement goals to Chilkoot and Chilkat Lakes for the 1982 season were 80-100 thousand and 60-70 thousand sockeye salmon, respectively. The escapements realized were 102,973 fish to Chilkoot and 78,986 to Chilkat Lake.

Figures 1 and 2, which present the daily escapements to Chilkoot and Chilkat Lakes, portray timing differences between the two stocks in which Chilkoot peaked approximately 6 weeks before Chilkat. Figure 5 presents a comparison of the Chilkoot and Chilkat stocks as they appeared in the 1982 Lynn Canal weekly gill-net catches; Chilkoot peak catches preceded Chilkat peak catches by approximately 2 weeks and were roughly comparable in size.

Discussion:

The upper limit of escapement for both systems was reached or exceeded. Fish returning to Chilkoot were somewhat more easily managed than Chilkat fish. This was due to the proximity of the weir to the fishery and the capability of management to move the effort into Lutak Inlet and intercept the run when it appeared from the weir counts that the escapement goals were about to be exceeded. However, management's ability to "cut off" the Chilkoot run in Lutak Inlet, during the 1982 season, may have been somewhat limited by the appearance of higher than usual numbers of 2-ocean fish which appeared to be less prone to departure by the gillnet gear.

The Chilkat sockeye salmon were more difficult to manage primarily because of the lack of timely escapement information to that system which was necessary for the formulation of in-season regulatory measures related to that stock. The management of this stock may have been further complicated by the apparent gear selectivity towards the larger 3-ocean fish. Catch-per-unit-effort was used as one measure of run strength. If a strong return of 2-ocean fish had been in progress, with an average or weak return of 3-ocean fish, and the 2-ocean fish were not represented in the catch relative to their strength, the run could have been underharvested.

A comparison of Figure 1 (1982 Chilkoot daily escapements) and Figure 5 (Chilkoot-Chilkat weekly catch through time, 1982) shows that the weekly catch of Chilkoot fish corresponded quite closely to the escapements at Chilkoot weir. However, peak catches of Chilkat sockeye salmon preceded the peak escapement at Chilkat weir by approximately 4 weeks. Conclusions that may be drawn by this comparison are as follows: (1) In-season escapement data provided by Chilkoot weir and used in conjunction with weekly catch data provided a reliable basis for the management of this stock in 1982, (2) the lag observed between the appearance of Chilkat fish in the fishery and their subsequent arrival at Chilkat weir precluded the use of this escapement data for in-season management application and, (3) the lack of timely in-season escapement data at Chilkat weir tended to generate under-estimates of the true run strength and resulted in the escapement goal being exceeded.

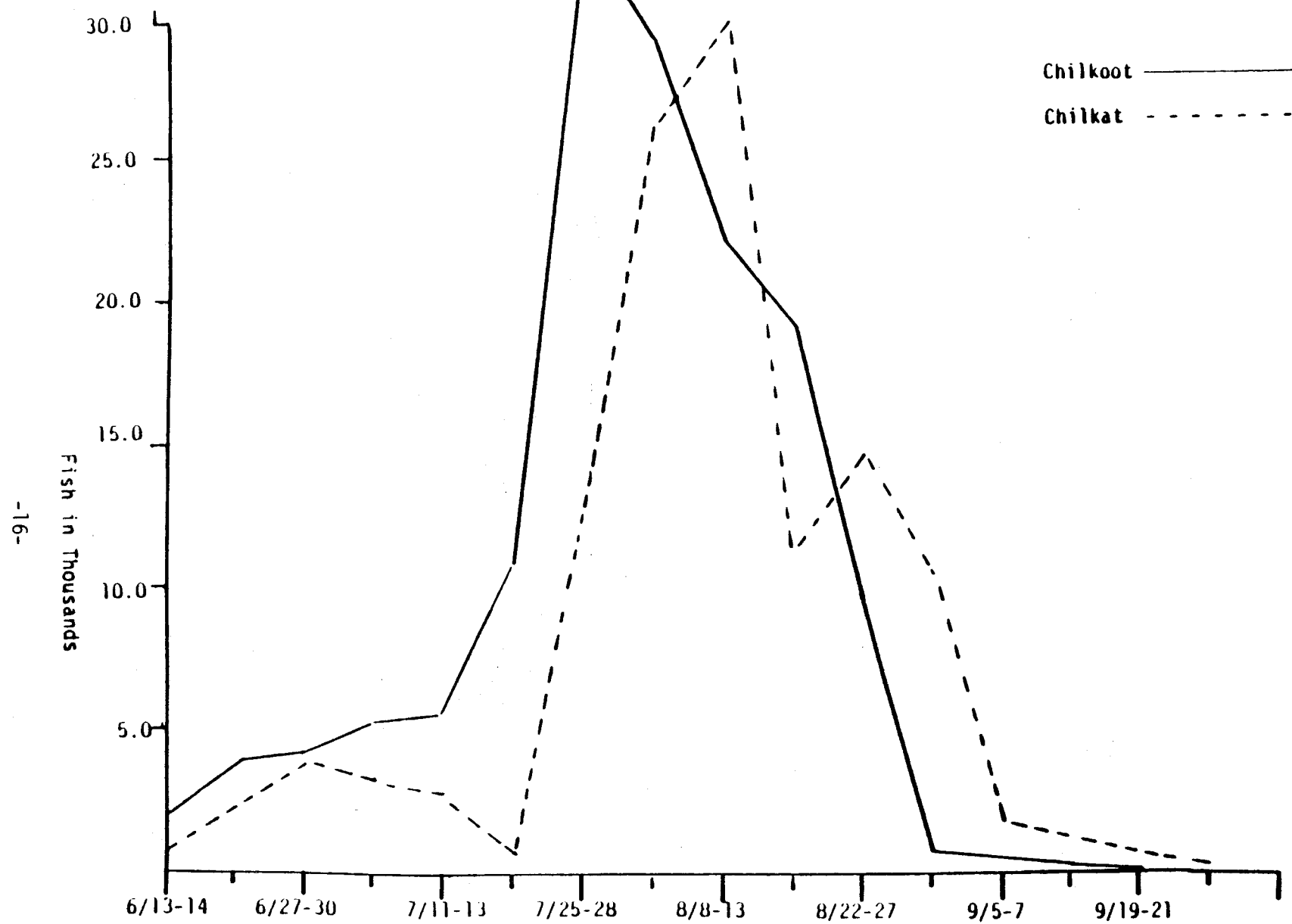


Figure 5. Comparison of the weekly catches of Chilkoot and Chilkat sockeye salmon, 1982.

Evaluation of Existing Escapement Goals

The escapement goals for Chilkoot and Chilkat Lakes have been in effect since 1976 and have been reached or exceeded 6 years out of 7 at Chilkat and 5 out of 7 years at Chilkoot. Returns from these brood year escapements were used as a basis for judging the adequacy of the respective escapement goals.

Methods:

Returns of sockeye salmon to the Chilkoot and Chilkat Lakes escapements were allocated to the respective brood years by age analysis of scale samples collected from the adults. Age analysis of the catch was used in the same manner as that of the escapement after first allocating the catch to the respective stocks through scale analysis procedures (Marshall et al. 1982). The total returns by brood year were calculated as the sum of the catch and the escapement. Spawner-return ratios were then calculated for comparison with preceding years.

Results:

Tables 6 and 7 present the returns of sockeye salmon to Chilkoot and Chilkat Lakes beginning with the 1970 Chilkat and 1976 Chilkoot brood years. Escapement return ratios for the 1976 and 1977 Chilkoot brood years were 1:1.73 and 1:2.3, respectively. Brood year escapements that produced these returns were 71,294 and 97,212 fish. Brood year returns to Chilkat Lake ranged from 1:2.2 to 1:3.7 from the 1972 and 1977 brood years, respectively. Escapements for these years were 51,860 and 40,334 sockeye salmon, respectively.

Discussion:

Escapement enumeration at Chilkoot Lake began in 1976 following the completion of Chilkoot weir. Brood year escapements prior to 1976 were unknown. Since returns from only two brood years were available, no conclusions regarding the adequacy of the escapement goals for Chilkoot were made.

The escapement-recruit ratios observed for the Chilkat Lake sockeye indicated that higher returns were realized from lower escapement levels. The data demonstrated that lower escapements may achieve a higher survival of their progeny than higher escapements, but not produce the numbers of fish possible from large escapements. For example; Two fish may achieve a spawner-recruit ratio of 1:50 and effect the return of 100 fish for a net gain of 98 fish. However, if 100 fish were to spawn and achieve a spawner-recruit ratio of 1:10 the subsequent return would be 1,000 fish for a net gain of 900 fish. In the case of the 1977 brood escapement the higher spawner-recruit ratio resulted in a net gain of 88,435 fish, whereas, the 1974 escapement with a lower spawner-recruit ratio produced a net gain of 166,442 fish. For the purpose of this discussion net gain represents harvestable surplus.

Smolt Scale Analysis

Smolt scales were collected at Chilkoot and Chilkat weirs to provide data related to growth rates and age of the outmigrants.

Table 6. Returns of the Chilkoot Lake sockeye salmon stock, 1970-1977 brood years.

Brood Year	Brood Year Escapement	Return ¹ (Catch + Escapement)	Year of Return	Esc:Recruit
1970	N/A	13,615	1976	
1971	N/A	114,940	1976;77	
1972	N/A	218,966	1976;77;78	
1973	N/A	54,303	1977;78;79	
1974	N/A	161,167	1978;79;80	
1975	N/A	124,491	1979;80;81	
1976	71,294	123,489	1980;81;82	1:1.73
1977	97,212	220,116	1981;82;83 ²	1:2.3

¹ Returns from the 1970 and 1971 brood years are incomplete and are represented by returns that appeared in the catch and escapement of 1976 and 1977.

² Assume 0 (zero) 6-year fish for the purpose of this calculation.

Table 7. Returns of the Chilkat Lake sockeye salmon stocks, 1970-1977 brood years.

Brood Year	Brood Year Escapement	Return (Catch + Escapement)	Years of Return	Esc:Recruit
1970	41,085	28,339 ¹	1976	
1971	49,342	116,693 ²	1976,77	
1972	51,860	112,911 ³	1976,77,78	1: 2.2
1973	50,554	125,679	1977,78,79	1: 2.5
1974	84,287	250,729	1978,79,80	1: 3.0
1975	41,508	128,772	1979,80,81	1: 3.1
1976	69,984	166,827	1980,81,82	1: 2.4
1977	40,334	147,834	1981,82,83	1: 3.7

¹ Return of 6-year fish only - 4's and 5's unaccounted for.

² Return of 5- and 6-year fish only 4's unaccounted for.

³ Return of 4-, 5-, and 6-year fish; other age groups considered minor.

Methods:

Scale samples and length measurements were collected from approximately 40 smolts per day. Scales were read to determine the age.

Results:

Table 8 presents the percentage composition by stock of one and two annulus sockeye salmon smolt by average length and range in length. The average 1982 one annulus Chilkoot smolt was 67 mm as opposed to 106 mm for Chilkat smolt. Chilkoot 2 annulus smolt averaged 64 mm and Chilkat 116 mm. The age composition for Chilkoot smolt was 64% one annulus and 36% two annulus, respectively. The Chilkat smolt sample indicated that 93% of the outmigrants were one annulus fish and 7% were two annulus.

Discussion:

The size differences noted between Chilkoot and Chilkat smolt of like ages corresponds with similar differences in scale growth. These differences will continue to provide a means of identifying the respective stocks as they appear in the Lynn Canal gillnet catch.

MONITOR SOCKEYE SALMON STOCKS IN OTHER SOUTHEASTERN ALASKA SYSTEMS AND FISHERIES AND STOCK INTERCEPTION STUDIES

Introduction

Extensive escapement monitoring and catch and escapement sampling was undertaken in Southeastern Alaska and British Columbia, Canada during the 1982 season. This increased effort was partially due to the initiation of studies designed by U.S.-Canada Treaty Negotiation participants to resolve questions relating to sockeye salmon stocks contributing to intercepting fisheries conducted by the two countries in southern Southeastern Alaska and northern British Columbia.

Objectives

The objectives of this program segment were as follows: (1) maintain escapement records for other major sockeye salmon systems, e.g., Situk River, Tahltan Lakes; (2) maintain catch records for all Southeastern gillnet and seine fisheries and; (3) collect scale samples for age determination to explore the potential for stock identification through scale analysis in other Southeastern escapements and fisheries.

Methods

Weirs operated on the Situk River and Tahltan Lake by the ADF&G and the Canadian Department of Fisheries and Oceans (CDF&O), respectively, provided escapement data and scale samples. The Southern Southeast Regional Aquaculture Association (SSRAA), under contract to the National Marine Fisheries Service (NMFS), operated weirs at Karta, Sarkar, Hetta, and Kegan Lakes. Alaska Department of Fish and Game's Fisheries Rehabilitation, Enhancement, and Development Division (FREDD) operated weirs at Hugh Smith, McDonald, Speel, Falls, and Redoubt Lakes.

Table 8. Sockeye salmon smolt length analysis by age class, 1972 through 1982.

Year	Location	-----One Annulus-----			-----Two Annuli-----		
		x Length (mm)	Range (mm)	n	x Length (mm)	Range (mm)	n
1973	Chilkoot Lake	70	58-90	22	71	61-82	78
1974	Chilkoot Lake	64	51-80	63	74	51-91	37
1975	Chilkoot Lake	64	53-77	22	74	58-82	78
1976	Chilkoot Lake	60	50-75	87	70	62-105	13
1977	Chilkoot Lake	66	52-78	86	71	60-79	14
1978	Chilkoot Lake	62	53-71	100	--	---	0
1979	Chilkoot Lake ¹	--	---	--	--	---	0
1980	Chilkoot Lake	59	49-81	100	--	---	0
1981	Chilkoot Lake	57	43-85	98	64	52-72	2
1982	Chilkoot Lake	67	46-69	64	64	56-74	36
1972	Chilkat Lake	103	86-118	5	118	91-146	95
1973	Chilkat Lake	91	72-111	84	101	82-137	16
1974	Chilkat Lake	88	82-115	85	104	91-104	15
1975	Chilkat Lake	90	80-115	15	110	85-126	85
1976	Chilkat Lake	97	83-122	71	111	93-139	29
1977	Chilkat Lake ¹	--	---	--	--	---	--
1978	Chilkat Lake	98	74-123	93	109	96-120	7
1979	Chilkat Lake ¹	--	---	--	--	---	--
1980	Chilkat Lake	100	90-115	92	101	96-114	8
1981	Chilkat Lake	107	90-134	89	108	98-135	11
1982	Chilkat Lake	106	80-116	93	116	108-125	7

¹ No smolts collected.

Results

Escapements to the systems studied are presented in Table 9. In order of magnitude of escapement the top five sockeye salmon systems were: Chilkoot Lake (102,973), Chilkat Lake (80,221), Situk River (75,000), Hugh Smith Lake (57,274), and Karta Lake (41,492). Tahltan and Sarkar Lakes escapements were 28,257 and 16,041, respectively. The remainder of the weired systems received escapements of less than 10,000 fish.

Table 10 presents the 1982 Situk River and Tahltan Lake escapements in comparison to the other years of record. The 1982 Tahltan escapement was 157% of the previous 23-year average of 17,976 fish. The Situk River 1982 escapement was approximately 66% of the previous 7-year average escapement of 114,510 fish.

Harvest records for Southeastern Alaska were reported by gear type, species, and subdistrict by the Commercial Fisheries Division's fish ticket reporting system. These data are reported in the Department's data processing R-series reports. The total commercial harvest of sockeye salmon in 1982 was 1,282,320 fish.

Age 1.3 fish were predominant in the majority of the escapements. Age 1.3 fish were also dominant in the gillnet catch; however, the purse seine catch showed more variation in the age of the fish harvested, with more 2-ocean fish than in the gillnet catch (McGregor 1983).

Discussion

The objectives of this program segment and the segment related to International Stock Interception investigations were met by an extensive study conducted through the joint efforts of the NMFS and the ADF&G. The results of this study were presented in detail by McGregor (1983).

RECOMMENDATIONS

Stock Separation

1. Continue smolt sampling at Chilkoot and Chilkat weirs to maintain a record of smolt age and growth for these stocks.
2. Maintain the present level of sampling in all temporal segments of the escapements of the escapements to Chilkoot and Chilkat Lakes for stock identification purposes.

Escapement Enumeration

1. Continue escapement enumeration at Chilkoot and Chilkat weirs to provide in-season management data and evaluation.
2. Continue to explore various methods of projecting escapement estimates of sockeye salmon to Chilkat Lake prior to their arrival at Chilkat weir.

Table 9. Sockeye salmon total season escapements to weired systems in South-eastern Alaska, 1982.

System Name	Count	Dates of Operation	Operator
Hugh Smith Lake	57,224	6/6 - 10/31/82	ADF&G
McDonald Lake	16,587	7/2 - 9/12/82	ADF&G
Kegan Lake	14,485	6/19 - 9/20/82	NMFS
Karta Lake	41,492	6/24 - 9/22/82	NMFS
Klakas Lake	2,065	7/30 - 11/19/82	ADF&G
Hetta Lake	5,387	6/16 - 8/27/82	NMFS
Klawock River	4,812	6/28 - 10/11/82	ADF&G
Chuck Lake	1,826	8/23 - 11/13/82	ADF&G
Sarkar Lake	7,657	6/14 - 8/22/82	NMFS
Salmon Bay Lake	16,041	6/26 - 9/2/82	ADF&G
Tahltan Lake	28,257	7/11 - 9/4/82	CDF&O
Falls Lake	1,687	6/30 - 8/27/82	ADF&G
Auke Lake	1,334	7/19 - 9/30/82	NMFS
Redoubt Lake	430	6/23 - 8/22/82	ADF&G
Sitkoh Lake	7,228	6/16 - 9/4/82	ADF&G
Neka River	48	7/1 - 8/11/82	ADF&G
Chilkat Lake	102,973	6/6 - 9/16/82	ADF&G
Situk Lake	75,000	5/12 - 8/25/82	ADF&G

Table 10. Annual sockeye salmon escapement through Tahltan Lake and the Situk River weirs, 1959-1982.

-----Tahltan-----		
Year	Number of Sockeye	Period Operated
1959	4,311	N/A
1960	7,000	N/A
1961	16,619	N/A
1962	15,000	N/A
1963	1,780	N/A
1964	19,352	N/A
1965	1,471	N/A
1966	21,580	N/A
1967	38,801	7/12 - 8/25
1968	19,729	7/07 - 8/27
1969	11,706	7/09 - 8/18
1970	8,269	7/06 - 9/07
1971	18,523	7/20 - 8/18
1972	41,354	7/03 - 8/21
1973	2,877	7/11 - 9/07
1974	8,106	7/04 - 9/13
1975	23,911	N/A
1976	23,111	8/02 - 8/21
1977	23,978	7/24 - 8/24
1978	22,978	7/11 - 8/26
1979	10,211	N/A
1980	12,000	N/A
1981	50,790	N/A
1982	28,257	N/A

-Continued-

Table 10. Annual sockeye salmon escapement through Tahltan Lake and the Situk River weirs, 1959-1982 (continued).

-----Situk-----		
Year	Number of Sockeye	Period Operated
1960	26,900	N/A
1961	61,000	N/A
1962	31,000	N/A
1963	26,500	N/A
1964	41,300	N/A
1965	58,000	N/A
1966	75,000	N/A
1967	48,000	N/A
1968	41,000	N/A
1969	40,800	N/A
1970	59,000	N/A
1971 ¹	138,000	N/A
1972	80,400	N/A
1973	46,000	N/A
1974	40,000	N/A
1975 ¹	50,000	N/A
1976 ¹	116,989	6/10 - 8/22
1977 ¹	216,632	6/07 - 8/17
1978 ¹	147,174	6/06 - 8/18
1979 ¹	130,000	5/31 - 8/18
1980 ¹	79,059	6/ - 7/29
1981 ¹	61,720	6/05 - 8/15
1982 ¹	75,000	5/12 - 8/24 ²

¹ Years of weir operation on the Situk River. All other years' escapements for the Situk were derived from aerial and foot surveys.

² Early start-up was Sport Fish Division's effort to obtain a steelhead escapement count.

Escapement Goals

1. Continue to evaluate brood year production as a means of establishing escapement goals.

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